

Marked-up Version of Claims

1. A hollow fiber porous membrane made of a perfluorinated thermoplastic polymer having an essentially skinless surface on at least one surface and an IPA flow time of less than about 3000 seconds.
2. The membrane of Claim 1 wherein said membrane is asymmetric.
3. (Amended) The membrane of claim 1 [or 2] wherein the IPA flow time is less than about 2000 seconds.
4. (Amended) The membrane of Claim 1 [or 2] wherein the IPA flow time is less than about 1500 seconds
5. (Amended) The membrane of claim 1 [or 2] wherein said perfluorinated thermoplastic polymer is poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) or poly(tetrafluoroethylene-co-hexafluoropropylene).
6. The membrane of Claim 5, wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is propyl, methyl, or blends of methyl and propyl.
7. A method of producing a hollow fiber porous membrane from a perfluorinated thermoplastic polymer having an essentially skinless surface on at least one surface comprising:
 - (a) dissolving said perfluorinated thermoplastic polymer in a solvent that forms an upper critical solution temperature solution with said polymer,
 - (b) extruding said solution through an annular die, a portion of said die being submerged in a cooling bath, and maintained at a temperature sufficiently high to prevent said solution from prematurely cooling,
 - (c) extruding said solution into said cooling bath,
 - (d) cooling said solution to below the upper critical solution temperature to cause separation into two phases by liquid-liquid phase separation, said phases being a polymer rich solid phase, and a solvent rich liquid phase, to form a gel fiber,
 - (e) extracting said solvent from said gel fiber to form a porous hollow fiber membrane,
 - (f) drying said porous hollow fiber membrane under restraint.

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8. The method of Claim 7 wherein said portion of said die being submerged is the die tip.
9. The method of Claim 7 wherein said perfluorinated thermoplastic polymer is dissolved in a concentration of from about 12% to about 35% by weight in a solvent that forms an upper critical solution temperature solution with said polymer.
10. The method of Claim 7 wherein step (b) comprises extruding said solution in an essentially horizontal attitude through an annular die, said die maintained at a temperature sufficiently high to prevent said solution from prematurely cooling, wherein the tip of said die penetrates through a wall separating said the body of said die from cooling bath, exposing the die exit to said cooling bath liquid.
11. The method of Claim 7 wherein the solvent has a boiling point lower than the temperature of the gel fiber at the die tip exit.
12. The method of Claim 7 wherein the solvent is a low molecular weight saturated chlorotrifluorohydrocarbon polymer.
13. The method of Claim 12 wherein the solvent is HaloVac® 60 or HaloVac® 56 or blends thereof.
14. (Amended) The method of Claim[s] 7[, 8, 9, 10, 11, 12, or 13] wherein said perfluorinated thermoplastic polymer is poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) or poly(tetrafluoroethylene-co-hexafluoropropylene).
15. The method of Claim 14 wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is propyl, methyl, or of blends of methyl and propyl.
16. (Amended) The method of Claim[s] 7[, 8, 9, 10, 11, 12, or 13] wherein said cooling bath liquid consists of a non-solvent for said perfluorinated thermoplastic polymer.
17. The method of Claim 14, wherein said cooling bath liquid consists of a non-solvent for said perfluorinated thermoplastic polymer.
18. (Amended) The method of Claim[s] 7[, 8, 9, 10, 11, 12, or 13] wherein said cooling bath liquid consists of the group selected from silicone oil or dioctylphthalate.

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19. The method of Claim 14, wherein said cooling bath liquid consists of the group selected from silicone oil or dioctylphthalate.

20. (Amended) A hollow fiber porous membrane produced from a perfluorinated thermoplastic polymer having an essentially skinless surface on at least one surface, and a IPA flow time of less than about 3000 seconds produced by the method of Claim[s] 7[, 8, 9, 10, 11, 12, or 13].

21. The membrane of Claim 20 wherein said membrane is asymmetric.

22. The membrane of Claims 20 wherein said perfluorinated thermoplastic polymer is selected from the group consisting of poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) or poly(tetrafluoroethylene-co-hexafluoropropylene).

23. The membrane of Claim 22, wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is selected from the group consisting of essentially all propyl, of essentially all methyl, or blends of methyl and propyl.

24. (Amended) A hollow fiber contactor membrane made of a perfluorinated thermoplastic comprising a porous surface on both diameters. [The membrane of Claim 21 wherein said perfluorinated thermoplastic polymer is selected from the group consisting of poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) or poly(tetrafluoroethylene-co-hexafluoropropylene).]

25. (Amended) The membrane of Claim 24 wherein said perfluorinated thermoplastic polymer is selected from the group consisting of poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) and poly(tetrafluoroethylene-co-hexafluoropropylene). [The membrane of Claim 24, wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is selected from the group consisting of essentially all propyl, of essentially all methyl, or blends of methyl and propyl.]

26. (Amended) The membrane of Claim 25 wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is selected from the group consisting of propyl, methyl, and blends of methyl and propyl. [A hollow fiber contactor membrane made of a perfluorinated thermoplastic comprising a porous surface on both diameters.]

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27. A hollow fiber contactor membrane made of perfluorinated thermoplastic comprising a unskinned surface both diameters capable of liquid-gas mass transfer with a Sherwood number equal to about 1.64 times the Graetz number to the 0.33 power in a range of Graetz numbers of from about 5 to about 1000.

28. (Amended) The membrane of [any one of] Claim[s] 26 [and 27] wherein said perfluorinated thermoplastic polymer is selected from the group consisting of poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) and poly(tetrafluoroethylene-co-hexafluoropropylene).

29. (Amended) The membrane of Claim [28] 27 wherein the alkyl of said poly(tetrafluoroethylene-co-perfluoro(alkylvinylether)) is selected from the group consisting of propyl, methyl, and blends of methyl and propyl.

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